The focus of this report is to evaluate the performance, compatibility, and feasibility of thin client Server based computing for the schools operations. The Wyse Winterm client will be examined throughout the report as alternatives to the traditional desktop PC network model.

The report will give an overview of the thin clients by describing some of the advantages, Disadvantages, and other issues necessary to consider when examining thin client/server-based Computing. The report will also provide detailed specifications of the server and the thin clients used in the Study. It will also include benefits of and problems within the thin client network. Finally the report will also be dedicated to detailing the experiment that was conducted and analysing the data that was collected.

**Some question to consider (put your thinking cap on!):**

* Is Thin Client Server Based Computing technology a viable alternative to the standard networked PCs?
* How compatible are thin clients with the current software used? And other applications in use today?
* How does the performance of the Client/Server infrastructure used in thin client applications compare with the stand-alone computers most commonly used today?
* How will the typical maintenance issues handled by an IT staff be reduced or changed by this architecture?

# What is a Thin Client Network? (USING GOOGLE OS)

A thin client network operates by concentrating computing power on a central server, with

‘Client’ machines (i.e., computers connected to the network) doing less computing locally. In

Fact, the central server performs most of the computing tasks, stores data and hosts all the

Software applications. This allows low-powered computers and older, outdated desktop

Machines to run applications that normally would require higher specification computers.

## Main Advantages of a Thin Client Network.

• Highly reliable system that delivers dependable computing for the school

• Technical issues are minimised for teachers, as they are centralised on a server(s)

• Limited risk of virus attack– as virus management is centrally controlled on servers(s)

• Standard personal desktop, programmes and data files available from any login point

• Small silent thin client computers that consume less energy and produce less heat

## Main Disadvantages of a Thin Client Network.

• As the server(s) is critical to the operation of all computers on the network, there is a

Higher impact to the school if the server(s) fails. A redundant application server (i.e. a

second server) is required in case of failure with the main application server.

• A higher level of planning is required to ensure that all parts of the system work

Properly together, hardware, software etc.

• Technical expertise is more specialised and as a result may be more expensive.

• All computers need to be connected to a thin Client server in order to operate.

Standalone PCs cannot avail of server based learning applications.

## A thin client network consists of the following four elements:

1. **Server:**

The central server in a thin client network is often called the ‘terminal server’. It is a powerful,

high specification machine, capable of handling a large number of logged-in clients. It should:

• Be a multi-processor system (i.e., have two or more processors)

• Possess a minimum of 40MB of memory (RAM) for each client on the system

• Possess an additional 500MB of memory for the operating system

• Have a large storage capacity as all information will be stored on the server

• Be located in a secure locked room and only accessible to the network administrator,

as all of the client systems depend on it for their computing power

1. **Client Devices (Clients)**

Simply speaking, a client can be defined as a ‘user’ (in the context of a client/server

relationship). There are a number of devices that can function as clients, but from a school’s

Perspective, desktop computers are the most familiar type of device.

**Devices optimised for thin-client computing**

These clients are effectively ‘dumb’ terminals. Their main function is to act as a means of

Connecting to the computing power of the server as the list indicates such devices have fewer components then normal PC:

* Microprocessor
* No hard disk
* No floppy disk or CD drive
* As few moving parts as possible
* 512MB of ram or greater

**3) Network Infrastructure**

Clients are connected to the terminal server via cables. As a general rule, these cables should be capable of transferring data a minimum of 100Mbps

**(4) Software**

Windows 2003 and Linux are the two operating systems most commonly deployed on servers. The entire range of application software being used by the school needs to be installed on the server. When is use, software may appear to be running on the desktop or client computer, but it is actually running on the server. The software installed on the client computer allows it connect to the server. Each client uses a ‘protocol’ to connect to the server.

**Technical Considerations**

* There are numerous advantages to using thin client networks in schools but the most compelling one has to be the ease with which large numbers of clients can be managed.
* New applications and upgrades only need to be loaded onto the server once. They then become instantly available on all client devices.
* Thin clients use less bandwidth than other networks as there is much less data travelling across the network in this arrangement. In fact, keystrokes, mouse clicks and screen images make up the bulk of the data being transferred.
* Because the server handles all application processing and memory demands, legacy computers can function as a thin client and still run up-to-date software, however technical support costs on older PCs are higher due to higher failure rates.

This below figure shows an example of a thin client. The user has a keyboard, mouse, and monitor, and all processes are executed by the server. The device contains no hard disk, expansion cards, disk drives, or memory cards.

# The benefits to the school for implementing thin client computing

To the end user of the device, a thin client looks and behaves like an ordinary PC, but they are less expensive, faster, and more durable and easier to maintain and upgrade. Additionally, they can provide the school with the following benefits:

**Increased reliability and consistency of technology**

In a school environment where pupils have regular network access, their natural curiosity can lead to inadvertent and sometimes deliberate acts of vandalism to the network, software and hardware.The resultant downtime and network outage leads to disillusionment with the reliability and dependability of the IT infrastructure, for both staff and pupils.

With a thin client environment, all data and applications are held securely on the central server and only keystrokes, mouse clicks and screen images travel across the network. When students log in, the server automatically provides them with their preconfigured desktop configuration: they only see the applications and data they use and access to system controls and other applications and data is prevented.

**Reduced cost of technology**

The true cost of technology is not just the initial costs of hardware and software, but also the cost of supporting the IT infrastructure over time. Many schools fall into the trap of not budgeting for these support costs and as a result they tend to be hidden, even though they can be as high as the initial purchase costs.

**Increased** **security**

By concentrating data, applications and processing power onto a central server(s), the thin client model reduces the security risks of data loss and equipment theft. It also reduces the backup requirement of the school as there will only be a need to backup the critical server(s), rather than many desktops, to ensure that rapid recovery from a catastrophic situation can be achieved.

**Green Computing**

Reducing energy consumption is an attractive goal not only due to increasing energy costs, but also from the standpoint of natural resources and environmental conservation. There are many reasons for implementing green IT systems, and hardware that is speciﬁcally designed for thin clients seems to ﬁt in perfectly here.

In a comparison with other alternatives that have similar possibilities to thin clients on other counts,

Thin client technology has an important point in favour of its aptness for green computing.

# Lower Total Cost of Ownership

The main advantage of thin client computing noted by most experts is a reduction in Total Cost of Ownership (TCO). TCO is an analysis model, use to explain the costs of purchasing and maintaining a computing environment. The purchase price of the computers themselves is only a small part of TCO. Other costs include repairing computer hardware, installing and updating software, network downtime, and powering the computing infrastructure.

# Power Savings

Power savings have become a huge issue, especially in today’s time where power usage continually has rising energy costs. Several studies measuring the power consumption of computing devices have had varying results, but have shown consistently that thin clients consume less power than PCs.

The below table displays a comparison of power consumption in terms of watts showing that thin clients consume up to 85 percent less than a typical PC

|  |  |  |
| --- | --- | --- |
| **Description** | **Normal pc** | **Thin client** |
| Plugged in | 10 watts | 6.6 watts |
| Powered on | 26.4 watts | 6.7 watts |
| Running application e.g. word | 10.1 | 5.8 |
| Power down device | 9.6 watts | 5.2 watts |

# APPLICATION SERVER SPECIFICATIONS

The application server that was used in this report was sourced through DELL. The design of this server was based on three criteria:

* Minimize the cost of the server
* Ample storage for all classroom and lab applications
* Sufficient processing power to accommodate up to thirty simultaneous users

The table below shows the server specifications:

|  |  |
| --- | --- |
| **Dell server** | **Dell powerdege specs** |
| **Processor** | Dual AMD opteron 244 CPUS |
| **Memory** | 8GB |
| **Storage Capacity** | 300 GB X 3 |
| **Operating System** | Windows Server 2003 |
| **Drives** | CD DVD drive |
| **Cost** | **$2400.00** |

# Think Client Specifications

WYSE WINTERM V90 Dell thin Client

* Hassle Free Maintenance
* Energy and Space Efficient design
* The system also uses a meager 17.2 Watts when operating, compared to nearly 170 Watts for most desktop PCs.
* Security
* Portability
* 

# What is sustainable management principles

Sustainable Computing is a principle that embraces a range of policies, procedures, programs, and attitudes that run the length and breadth of any use of information technologies. It is a holistic approach that stretches from power to waste to purchasing to education and is a life-cycle management approach to the deployment of IT across an organization. The concept of Sustainable Computing considers total cost of ownership, the total environmental impact, and the total benefit of technology systems.

## Power

These days with power consumption and costs on the rise, saving energy is becoming a larger issue.

There are a multitude of ways to save energy by adjusting settings on PCs, printers, and peripherals.

## Using devices / machines with eco labels

* compliance with ISO 14024 or ISO 14021 at the level of EPEAT Silver or equivalent as a minimum standard for relevant ICT equipment;
* compliance with the current ENERGY STAR version for relevant ICT equipment;

## Let’s look at printing / printers

The printers themselves can have an impact on sustainability. Energy consumption should not be the main concern at the purchasing phase of the printers. The most important is it should be Energy Star compliant!

Print settings are a final consideration. Duplex printing should be used where appropriate.

## The following should be considered and investigated further:

1. The school should conduct an environmental risk assessment and integrate significant ICT aspects into their business model.
2. The school will implement strategies to raise awareness, provide training programs, and monitors and reports performance through various software applications.

# Key Performance Indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **Hardware** | **SD-KPI 1: Energy / greenhouse gas efficiency of production / products in use**  **(tons CO2/pa)** | **SD-KPI 2: Proportion of products with “Design for Environment” / Eco-Label**  **‘eco-friendly’**  **(√)**  **or (x)** | **SD-KPI 3: Emissions of (hazardous) waste and toxic materials**  **At disposal**  **Yes or No** |
| Server | .045 x 24 x 365 x6.89560/10000 = 0.271824552 | Generic server used hence NO | Generic server used hence NO |
| Switch 24 Port | 0.008x24x365 x6.89560/10000=0.048324 | Power consumption automated based on length of power lead and cables connected.  Reference from tp-link.com/lk/products | ROHS = yes |
| Thin Client x 20 | 0.009x8x262 x6.89560/10000=0.012908(per monitor)  Total = 0.25816 (for 20 ) | WYSE WT3125SE model = NO logo  Ultra thin client Y210 = NO logo | Y210 ROHS = yes  WYSE WT3125SE = NO |
| Modem/router | 0.007x24x365 x6.89560/10000=0.042283 | Netgear green logo refer to website. | Nope |
| Printer | 0.016x24x365 x6.89560/10000= 0.096648 | Yes = EPA Energy Star symbol (on the box) | No |
| Monitor | 0.018x8x262 x6.89560/10000=0.026015 (per monitor) | Yes = EPA Energy Star symbol (on the box) | NO |
|  |  |  |  |

# Hardware Data Findings

|  |  |  |  |
| --- | --- | --- | --- |
| **Hardware** | **Cost** | **URL** | **Average power**  **E.g. browser open** |
| Server | $2000.00 | Dell base model per dell.com.au | 45 watts idle |
| Switch 24 Port Samsung | $150.00 | [samsung](http://www.ebay.com.au/itm/TP-Link-TL-SG1024-24-Port-10-100-1000Mbps-Gigabit-Rackmount-Switch-24-Port-/221074839891?pt=LH_DefaultDomain_15&hash=item3379165953).com.au | Idle 7 -8 watts (2 thin clients attached) |
| Thin Client x 20  Wyse WT3125SE | $70.00 \* 20 = $1500.00 | <http://www.ebay.com.au/itm/WYSE-WT3125SE-THIN-CLIENT-TERMINAL-/170465092590?pt=LH_DefaultDomain_15&hash=item27b082e3ee> | 9 watts (each) |
| Modem/router | $30.00 | [www.officeworks.com.au](http://www.officeworks.com.au) | 6 watts + 1watt for dongle |
| Printer P1102w | $34.99 | [www.officeworks.com.au](http://www.officeworks.com.au) | Idle 8 -16 watts |
| Monitor Samsung FP5315 x 2 | $150.25 | [www.officeworks.com.au](http://www.officeworks.com.au) | 18 watts (each) |
| Thin Client x 20  Ultra Thin Y210 | USD96.99 | <http://www.aliexpress.com/store/product/Multi-user-thin-client-Model-Y210/506847_469333140.html> | 7 watts (each) |
| TOTAL | $2484.24 |  | 152 watts (Server + 2 thin clients + 3 monitors+ printer)  COST $0.86 per day |
| TOTAL (estimated) | AUD3500.00 approx |  | 1000 Watts (Server & 20 thin clients) |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Class of hardware** | **Recommendation/s** | **Potential energy savings** | **Cost** | **Payback** | **Assumptions** |
| Common Equipment | **Newer equipment** | **20-50%** | **$1500** |  | **1** |
| Desktop Equipment | **Newer equipment** | **50%+** | **$427 each** |  | **2** |
| Printing Equipment | **Newer printer** | **30 – 50%** | **$330+** |  | **3** |

|  |  |  |  |
| --- | --- | --- | --- |
| **ITEM** | **CO2 Emissions** | **Cost** | **URL** |
| Web Client 1  WYSE DELL | 0.012908 | n/a est. $40 | n/a |
|  |  |  |  |

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# A great report on the client which has been discussed above:

# <http://www.wyse.com/sites/default/files/documents/case_studies/Dell-Wyse-CaseStudy-Babylon-10011390.pdf>